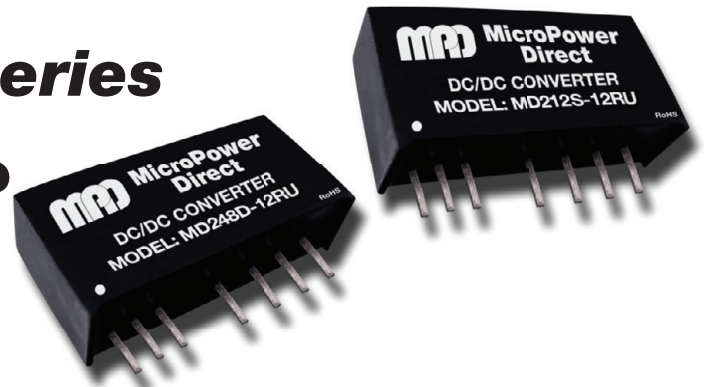


# MD200RU Series

## Wide 4:1 Input, 2W SIP Single & Dual Output DC/DC Converters



### Key Features:

- 2W Output Power
- Miniature SIP Case
- Wide 4:1 Input Range
- Single & Dual Outputs
- 1,500 VDC Isolation
- >1.0 MHour MTBF
- 21 Standard Models
- Industry Standard Pin-Out

RoHS



### Electrical Specifications

Specifications typical @ +25°C, nominal input voltage & rated output current, unless otherwise noted. Specifications subject to change without notice.

#### Input

| Parameter                 | Conditions         | Min. | Typ. | Max.  | Units |
|---------------------------|--------------------|------|------|-------|-------|
| Input Voltage Range       | 12 VDC Input       | 4.5  | 12.0 | 18.0  | VDC   |
|                           | 24 VDC Input       | 9.0  | 24.0 | 36.0  |       |
|                           | 48 VDC Input       | 18.0 | 48.0 | 75.0  |       |
| Startup Threshold Voltage | 12 VDC Input       | 3.0  | 4.0  | 4.5   | VDC   |
|                           | 24 VDC Input       | 4.5  | 6.0  | 9.0   |       |
|                           | 48 VDC Input       | 8.5  | 12.0 | 18.0  |       |
| Under Voltage Shutdown    | 12 VDC Input       |      |      | 4.0   | VDC   |
|                           | 24 VDC Input       |      |      | 8.0   |       |
|                           | 48 VDC Input       |      |      | 16.0  |       |
| Short Circuit Input Power |                    |      |      | 1,500 | mW    |
| Input Filter              | Internal Capacitor |      |      |       |       |

#### Output

| Parameter                    | Conditions                    | Min. | Typ.  | Max.  | Units    |
|------------------------------|-------------------------------|------|-------|-------|----------|
| Output Voltage Accuracy      |                               |      |       | ±2.0  | %        |
| Output Voltage Balance       |                               |      | ±1.0  | ±2.0  | %        |
| Line Regulation              | V <sub>IN</sub> = Min to Max  |      | ±0.3  | ±0.5  | %        |
| Load Regulation              | I <sub>OUT</sub> = 0% to 100% |      | ±0.5  | ±1.0  | %        |
| Ripple & Noise (20 MHz)      | See Note 1                    |      |       | 100   | mV P - P |
| Transient Recovery Time      | See Note 2                    |      | 300   | 500   | mSec     |
| Transient Response Deviation |                               |      | ±3.0  | ±5.0  | %        |
| Temperature Coefficient      |                               |      | ±0.01 | ±0.02 | %/°C     |
| Output Short Circuit         | Continuous (Autorecovery)     |      |       |       |          |

#### General

| Parameter             | Conditions  | Min.  | Typ. | Max. | Units |
|-----------------------|-------------|-------|------|------|-------|
| Isolation Voltage     | 60 Seconds  | 1,500 |      |      | VDC   |
| Isolation Resistance  | 500 VDC     | 1,000 |      |      | MΩ    |
| Isolation Capacitance | 100 kHz, 1V |       | 250  | 500  | pF    |
| Switching Frequency   |             |       | 300  |      | kHz   |

#### Environmental

| Parameter                   | Conditions          | Min. | Typ. | Max. | Units |
|-----------------------------|---------------------|------|------|------|-------|
| Operating Temperature Range | Ambient             | -40  | +25  | +75  | °C    |
| Operating Temperature Range | Case                |      |      | +105 | °C    |
| Storage Temperature Range   |                     | -55  |      | +125 | °C    |
| Cooling, See Note 3         | Free Air Convection |      |      |      |       |
| Humidity                    | RH, Non-condensing  |      |      | 95   | %     |

#### Physical

|               |                                        |  |  |  |  |
|---------------|----------------------------------------|--|--|--|--|
| Case Size     | See Mechanical Drawing (Page 2)        |  |  |  |  |
| Case Material | Non-Conductive Black Plastic (UL94-V0) |  |  |  |  |
| Weight        | 0.07 Oz (2.1g)                         |  |  |  |  |

#### Reliability Specifications

| Parameter | Conditions                      | Min. | Typ. | Max. | Units  |
|-----------|---------------------------------|------|------|------|--------|
| MTBF      | MIL HDBK 217F, 25°C, Gnd Benign | 2.8  |      |      | MHours |

#### Absolute Maximum Ratings

| Parameter                   | Conditions                  | Min. | Typ. | Max. | Units |
|-----------------------------|-----------------------------|------|------|------|-------|
| Input Voltage Surge (1 Sec) | 12 VDC Input                | -0.7 |      | 25   | VDC   |
|                             | 24 VDC Input                | -0.7 |      | 50   |       |
|                             | 48 VDC Input                | -0.7 |      | 100  |       |
| Lead Temperature            | 1.5 mm From Case For 10 Sec |      |      | 260  | °C    |

**Caution:** Exceeding Absolute Maximum Ratings may damage the module. These are not continuous operating ratings.

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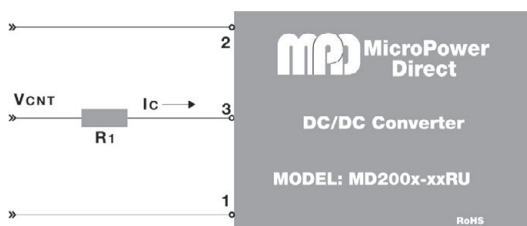
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| Model Number | Input         |             |              |         | Output        |                   |                   | Efficiency (% Typ) | Capacitive Load (µF, Max) | Fuse Rating Slow-Blow (mA) |
|--------------|---------------|-------------|--------------|---------|---------------|-------------------|-------------------|--------------------|---------------------------|----------------------------|
|              | Voltage (VDC) |             | Current (mA) |         | Voltage (VDC) | Current (mA, Max) | Current (mA, Min) |                    |                           |                            |
|              | Nominal       | Range       | Full-Load    | No-Load |               |                   |                   |                    |                           |                            |
| MD212S-03RU  | 12            | 4.5 - 18.0  | 183          | 60      | 3.3           | 500               | 0.0               | 75                 | 1,000                     | 500                        |
| MD212S-05RU  | 12            | 4.5 - 18.0  | 208          | 60      | 5.0           | 400               | 0.0               | 80                 | 1,000                     | 500                        |
| MD212S-12RU  | 12            | 4.5 - 18.0  | 204          | 60      | 12.0          | 167               | 0.0               | 82                 | 170                       | 500                        |
| MD212S-15RU  | 12            | 4.5 - 18.0  | 204          | 60      | 15.0          | 134               | 0.0               | 82                 | 110                       | 500                        |
| MD212D-05RU  | 12            | 4.5 - 18.0  | 208          | 60      | ±5.0          | ±200              | 0.0               | 80                 | ±470                      | 500                        |
| MD212D-12RU  | 12            | 4.5 - 18.0  | 202          | 60      | ±12.0         | ±83               | 0.0               | 82                 | ±100                      | 500                        |
| MD212D-15RU  | 12            | 4.5 - 18.0  | 204          | 60      | ±15.0         | ±67               | 0.0               | 82                 | ±470                      | 500                        |
| MD224S-03RU  | 24            | 9.0 - 36.0  | 92           | 30      | 3.3           | 500               | 0.0               | 75                 | 1,000                     | 250                        |
| MD224S-05RU  | 24            | 9.0 - 36.0  | 104          | 30      | 5.0           | 400               | 0.0               | 80                 | 1,000                     | 250                        |
| MD224S-12RU  | 24            | 9.0 - 36.0  | 102          | 30      | 12.0          | 167               | 0.0               | 82                 | 170                       | 250                        |
| MD224S-15RU  | 24            | 9.0 - 36.0  | 102          | 30      | 15.0          | 134               | 0.0               | 82                 | 110                       | 250                        |
| MD224D-05RU  | 24            | 9.0 - 36.0  | 104          | 30      | ±5.0          | ±200              | 0.0               | 80                 | ±470                      | 250                        |
| MD224D-12RU  | 24            | 9.0 - 36.0  | 101          | 30      | ±12.0         | ±83               | 0.0               | 82                 | ±100                      | 250                        |
| MD224D-15RU  | 24            | 9.0 - 36.0  | 102          | 30      | ±15.0         | ±67               | 0.0               | 82                 | ±470                      | 250                        |
| MD248S-03RU  | 48            | 18.0 - 75.0 | 46           | 20      | 3.3           | 500               | 0.0               | 74                 | 1,000                     | 100                        |
| MD248S-05RU  | 48            | 18.0 - 75.0 | 52           | 20      | 5.0           | 400               | 0.0               | 80                 | 1,000                     | 100                        |
| MD248S-12RU  | 48            | 18.0 - 75.0 | 51           | 20      | 12.0          | 167               | 0.0               | 82                 | 170                       | 100                        |
| MD248S-15RU  | 48            | 18.0 - 75.0 | 51           | 20      | 15.0          | 134               | 0.0               | 82                 | 110                       | 100                        |
| MD248D-05RU  | 48            | 18.0 - 75.0 | 52           | 20      | ±5.0          | ±200              | 0.0               | 80                 | ±470                      | 100                        |
| MD248D-12RU  | 48            | 18.0 - 75.0 | 51           | 20      | ±12.0         | ±83               | 0.0               | 82                 | ±100                      | 100                        |
| MD248D-15RU  | 48            | 18.0 - 75.0 | 51           | 20      | ±15.0         | ±67               | 0.0               | 82                 | ±470                      | 100                        |

## Notes:

- When measuring output ripple & noise, it is recommended that an external ceramic capacitor (0.47  $\mu$ F typ.) be placed from the +Vout to the -Vout pins for single output units and from each output to common for dual output models.
- Transient recovery is measured to within a 1% error band for a load step change of 75% to 100%.
- Free air convection is typically 20 LFM. The units should not be operated in still air (0 LFM).
- Exceeding the absolute ratings could damage the unit.
- It is recommended that a fuse be used on the input of a power supply for protection. See the Model Selection table above for the correct rating.

## Remote ON/OFF



The MD200x-xxRU remote control input (pin 3) is current controlled. The unit operates when this input is open. When the input is "high" (current is flowing into the pin), the converter shuts down. The input current to this pin should be kept between 2 mA and 4 mA. The diagram above shows a simple connection for the control pin.

Using a value of 1 k $\Omega$  for R1, a voltage level of 5V - 9V may be used to control the unit. The table below gives specifications for this feature.

## Remote On/Off

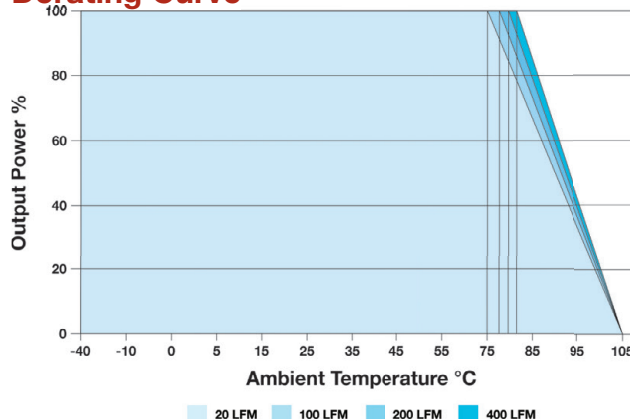
| Parameter             | Min. | Typ.                   | Max. | Units |
|-----------------------|------|------------------------|------|-------|
| Supply On             |      | Open or High Impedance |      |       |
| Supply Off            | 2    |                        | 4    | mA    |
| Standby Input Current |      | 2.5                    |      | mA    |

## Pin Connections

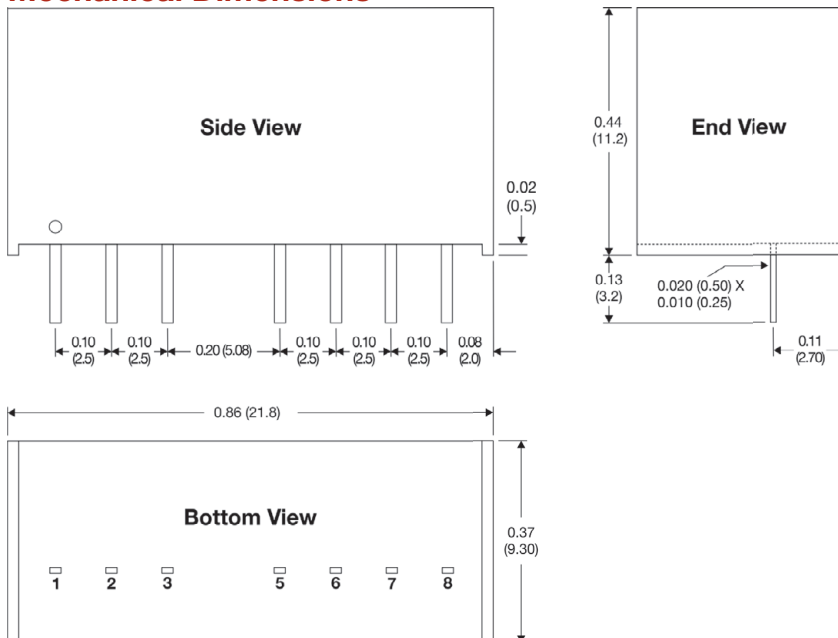
| Pin | Single        | Dual          |
|-----|---------------|---------------|
| 1   | -VIN          | -VIN          |
| 2   | +VIN          | +VIN          |
| 4   | Remote ON/OFF | Remote ON/OFF |
| 5   | NC            | NC            |
| 6   | +VOUT         | +VOUT         |
| 7   | -VOUT         | Common        |
| 8   | NC            | -VOUT         |

NC: No Connection

## Derating Curve



## Mechanical Dimensions



## Notes:

- All dimensions are typical in inches (mm)
- Tolerance x.xx =  $\pm$ 0.02 ( $\pm$ 0.50)
- Pin 1 is marked by a "dot" or indentation on the side of the unit



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